

X. NOTES ON THE DEVELOPMENT OF
SOME INDIAN ASCALAPHIDÆ
AND MYRMELEONIDÆ.

By F. H. GRAVELY and S. MAULIK.

[N.B.—The plate (v) illustrating this paper has not yet been received from Europe. It will be published in the next number of these "Records."']

CIRCUMSTANCES OF CAPTURE.

The three species of Ascalaphid and Myrmeleonid larvae described in this paper differ in habit from all larvae of these families whose habits have hitherto been described, in that they neither cover themselves completely with a cloak of debris in order to conceal their real nature from the insects on which they prey nor hide themselves under stones or in the ground, but live upon tree-trunks in hollows and crevices of the bark where the Ascalaphid larvae at least are rendered sufficiently inconspicuous by their form and colour alone (see plate v, figs. 2 and 3). The larvae of *Myrmeleon contractus*, Walk.¹ (figs. 5 and 6), were found by Mr. Paiva on December 20, 1909, at Bhogaon, Purneah District, Bengal, upon the trunks of some mango trees which were coated with dried mud. One specimen was found hidden in an actual pocket in this mud coat, from which only its jaws projected each in its own close-fitting groove; but all the rest (5 or 6) were lying on the surface, in at most a shallow depression, where, being somewhat pale in colour, they were seen without much difficulty. The larva (of an Ascalaphid) which has not yet been identified with any adult form (fig. 4) was obtained at the same place two days later on another mango tree with dark-coloured bark not plastered with mud, but hung with cobwebs and the debris which they catch. This specimen was found in a hollow of the bark where it was very hard indeed to discover. The *Pseudoptynx* larvae (figs. 1—3) were found by Dr. Annandale at Igatpuri in the Bombay Presidency on November 20, 1909. One of these was found by day on the rough bark of a tree-trunk where it was very inconspicuous, and two more were found on a recently whitewashed wall at night. In both cases the larvae were perfectly still when found.

¹ Our thanks are due to Prof. J. G. Needham, who is preparing an account of the Indian Neuroptera, for the identification of the mature insects reared from the larvae dealt with in this paper.

HABITS AND DEVELOPMENT IN CAPTIVITY.

Larvae.

The larvae were brought to Calcutta and kept in glass jars in one of the work-rooms of the Indian Museum. A thin layer of dry soil was placed at the bottom of the jar, a piece of rough bark was supported against the side in an upright position, and the top was covered with muslin. The food supplied consisted of flies, mostly "blue-bottles" (probably *Pycnosoma flaviceps*), but the larvae showed no special preference for any particular kind.

All the larvae hibernated during the winter, neither taking food nor caring to move about; but it was noticed in the case of a *Pseudoptynx* larva which happened to be moved from its chosen position on the bark, that it returned there during the following night. Most of the larvae hibernated immediately on being left to themselves in their cages, but the smaller of the two *Pseudoptynx* larvae kept alive took one or two flies on alternate days with considerable regularity till December 17. It remained inactive till February 21, 1910, and when flies were then again introduced into its cage it started feeding at once and continued to do so till March 23 when it died, still somewhat smaller in size than its companion.

Its companion commenced to feed again on February 24, but was not observed to eat anything more between this date and March 19 when it began to prepare for pupation—at most it cannot have eaten more than two or three flies during this time. The imago (which was deformed) emerged on April 4, 1910.

The other Ascalaphid larva commenced to feed again on February 28, and eat another fly on March 15, very shortly after which it was unfortunately lost. The *Myrmeleon* larvae eat nothing at all during the time of their captivity; one prepared to pupate on February 22 and emerged on March 21. Another prepared to pupate on February 26, but the pupa was not allowed to develop further.

The unidentified Ascalaphid larva not only resembled the *Pseudoptynx* larva in general form (compare figs. 1 and 4) but also in habits; and, except that in the former the mandibles always remained exposed in repose, the following account of the habits of the latter, which were more fully observed, is probably equally applicable to it and in large measure even to the *Myrmeleon* larvae also. It may be observed here that these last resemble the free-living larvae of other genera of Myrmeleonidae in not having the habit of walking backwards that is so well-known a characteristic of the pit-forming larvae of other species of the genus *Myrmeleon*. Their mandibles were kept continuously closed during their life in captivity and extended forwards in front of the head with their tips crossed.

The larva of the species of *Pseudoptynx* here described usually lies motionless in a depression of the bark on which it lives, and by flattening itself down as close as possible upon the bark the larva makes itself almost indistinguishable (see figs. 2 and 3). If

removed from the bark it will remain absolutely motionless for a time, feigning death.

When thus at rest on the bark the legs are entirely hidden beneath the body, and the long powerful mandibles are drawn back and held so widely open as to lie beneath the sides of the head and the lateral processes of the thorax. If, when the larva is hungry, a fly happens to touch it on any part of the head the mandibles are closed instantaneously and the fly captured between them. No suggestion of discrimination as to the qualities of the fly was ever observed in the process. After this the fly is shifted along towards the distal end of the mandibles, and if it is dropped before reaching its destination no effort is made to recover it. If the end is reached in safety the mandibles are thrust into the body, always between two segments—apparently they are too blunt to pierce any harder part of the integument. The sucking of the juices of the fly along the canal on the under side of each mandible is then commenced at once and the piston-like motion in these canals, by which suction is effected, may be seen under a hand-lens. From time to time one or other of the mandibles is withdrawn in order to commence sucking in another place, the fly being held aloft and quite clear of the bark throughout the whole time of feeding. Flies continued to move for a long time after they were caught; they did not appear to be poisoned as did those caught by Mr. S. Green's species in Ceylon (Westwood, 1888, p. 8). A fly is finished in from half an hour to an hour. The mandibles only—never the legs—are used in manipulating it.

Cocoons and Pupae.

The *Pseudoptynx* larva constructed its cocoon at the surface of the loose dry soil provided, by fastening together pieces of earth with tough silk (fig. 15).

The larvae of *Myrmeleon contractus* spun cocoons in crevices of the bark on which they were living, although all other Myrmeleonids of which the cocoon is known appear to spin in soil. Having found a suitable crevice the larva sits in it with the head erect and jaws projecting upwards, and proceeds to spin round the edge with silk extruded from a retractile spinneret at the posterior end of the abdomen, the abdomen being moved to and fro throughout the process. The edges of the cocoon become broader and broader, being carefully covered with dust as they are elaborated, and the aperture in the middle becomes narrower till finally the jaws are withdrawn and the cocoon or at least its outer covering completed. If a cocoon be opened it is found to consist of two layers of silk, the inner one being softer and more loosely spun together than the outer. When the mature insect emerges the pupal skin is left projecting from the aperture made in the cocoon (see figs. 9 and 10). Presumably the pupa eats its way through the silk with its peculiar jaws (fig. 12) as suggested by Westwood in the case

of a Ceylonese species of *Ascalaphus* (1888, pp. 11-12) and comes half out itself before the transformation takes place.

DESCRIPTIONS OF LARVAE AND PUPAE.

The following descriptions are based primarily on preserved specimens (in spirit); but a few notes on the living larvae have been incorporated with them.

Pseudoptynx, sp.

Larva (pl. v, figs. 1-3 and 14, and text-fig. A).—Length (excluding jaws 4 mm.) about 12 mm. Head cordate, flattened dorso-ventrally, somewhat broader than long, widest opposite the middle of the deep posterior sinus. Ocular tubercles (text-fig. A) not very prominent, somewhat flattened dorso-ventrally, each bearing six black ocelli all on the dorsal surface. Antennae scarcely reaching to the tip of the ocular peduncle, slightly swollen at the tip. Mandibles

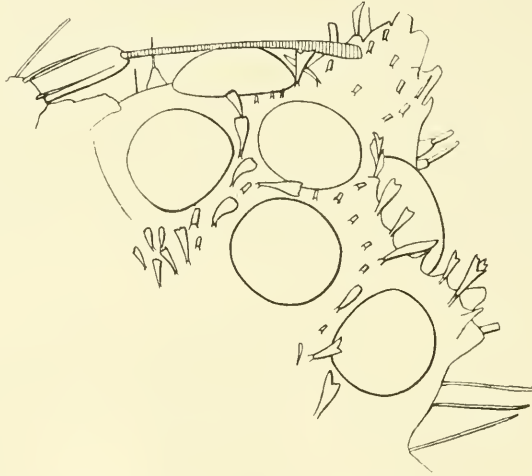


FIG. A.—Ocular tubercle of larva of *Pseudoptynx* sp., $\times 75$.

long, perfectly straight as far as the second and longest tooth, then strongly curved inwards to the tip; third tooth longer than first. Thorax flat: prothorax much narrower than head, broader than long, freely articulated with head and mesothorax. Mesothorax much broader than the head, bearing two pairs of lateral lobes each fringed with hairs—the anterior very large, bent back at an angle in the middle and slightly forwards again close to the tip, the posterior smaller, slenderer, and approximately straight. Metathorax broader than mesothorax and fused to it and to the abdomen; lateral lobes as in mesothorax but smaller, the anterior one not so strongly bent. Abdomen broad and flat; each segment except the last (9th) broader than long, and produced laterally to form a pair of processes fringed with hairs; last segment longer than broad, narrower behind than in front, truncate posteriorly, without lateral processes,

but with a pair of very distinct ventral lobes each bearing four stout blunt spines.

General dorsal colour dull, earth-like. Mandibles dark near the base, reddish in the middle, intense black from the longest tooth to the tip. Head dull brown, mottled with ochraceous between and for a short distance behind the ocular tubercles. Pronotum brown mottled with ochraceous. Mesonotum and metanotum brown near the mid-dorsal line, ochraceous speckled with brown laterally, these extensive pale lateral patches becoming more conspicuous as the larva grows older; the anterior pair of lateral processes of both meso- and metanotum paler than the posterior ones. Abdomen brown with a pair of transverse ochraceous bands on each of the first eight segments but most conspicuous on the anterior ones; these bands are arranged one behind the other so as to form a pair of pale longitudinal stripes continuous in front with the lateral patches of the thorax and fading gradually out behind; the ninth

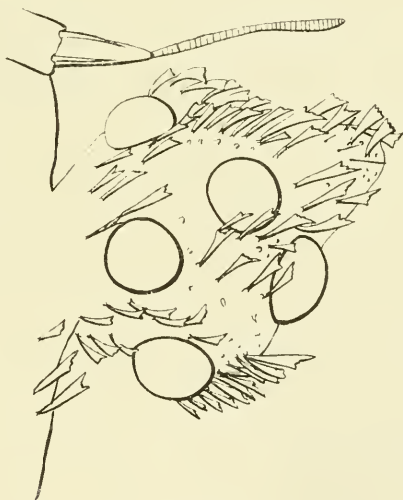


FIG. B.—Ocular tubercle of undetermined Ascalaphid larva from Bhogaon, $\times 75$.

segment is brown in front and ochraceous behind. The whole of the dorsal surface is rough in appearance, and the abdomen is much wrinkled transversely.

On the ventral side the colour of the mandibles resembles that of the dorsal; the head is polished and uniformly brown except for a spot in the middle line between the anterior parts of the two ocular tubercles, a short longitudinal stripe situated on each side about half-way between the ocular tubercles and the middle line, and a patch—bifid behind—at the base of each of these tubercles, all of which are ochraceous; the thorax and abdomen are ochraceous thickly speckled with brown.

Cocoon and Pupa (fig. 15).—Cocoon approximately spherical,

nearly 15 mm. in diameter. Composed of white silk; smooth and glistening inside, coated with attached pieces of soil on the outside. Pupa not examined before hatching for fear of interfering with the completion of its development. The empty skin shows the mandibles to have been stout and strongly toothed on the biting margin.

Undetermined Ascalaphid.

Larva (pl. v, fig. 4, and text-fig. B).—Total length (including mandibles) about 12 mm. Mandibles straight for a greater part of their length than in the *Pseudoptynx* larva; general dorsal coloration somewhat paler than in that larva; and anterior lateral processes markedly different from posterior instead of all being setose alike. As, however, the larva was lost before any complete description of it was drawn up, the figures alone will have to serve for further comparison with other larvae.

Myrmelcon contractus, Wlk.

Larva (pl. v, figs. 5—7 and 13, and text-fig. C).—Length (excluding mandibles 1.5 mm.) about 7 mm. Head approximately



FIG. C.—Ocular tubercle of larva of *Myrmelcon contractus*, Wlk., $\times 90$.

rectangular with the anterior angles sharply re-entrant and the posterior ones rounded; broader than long. Ocular tubercles (text-fig. C) not prominent, bearing six black eyes all in a circular patch on the dorsal surface. Mandibles (fig. 7) long, straight as far as the third tooth (*i.e.*, for about two-thirds of their length), then curved rather sharply inwards; the second tooth the longest, the first the shortest. Thorax flat; prothorax semi-lunar above with the anterior margin faintly convex, much narrower than the head, freely articulated with head and mesothorax. Mesothorax much broader than head, metathorax broader than mesothorax, each with two pairs of minute lateral processes arising just above their margin and not projecting beyond them (fig. 5); these processes are however usually obscured by a coating of mud which gives them the appearance of broad flat discs which do project beyond the margin of the body (fig. 6); mesothorax and metathorax fused together and to the abdomen. Abdomen short and broad, without lateral processes. Eighth segment with a pair of minute conical yellowish horns on the posterior margin below; ninth segment with a pair of loosely opposed and very faintly developed lobes

below the posterior margin, each bearing four stout blunt spines which are quite black.

General colour in life dirty whitish faintly tinged with pink dorsally. Head, mandibles, and pronotum brownish above, the first and last of these covered with a thin layer of fine dust. Meso- and metanotum and abdomen whitish with a faint bluish mid-dorsal line, and a pair of conspicuous black dorso-lateral lines; a slightly irregular row of brown spots on each side between the mid-dorsal and dorso-lateral lines; and numerous spots of the same colour scattered more or less symmetrically outside the latter. The mesonotum however, and to a less extent the metanotum, are obscured in life, like the head and pronotum, by symmetrically arranged plate-like layers of fine dust. Below, the mandibles are brown and the front margin of the head black; the rest of the body is whitish.

Cocoon and Pupa (figs. 8—12).—Cocoon composed of white silk, specked with particles of fine dust; 7 mm. in diameter externally; constructed in a hollow of the bark; consisting of a tough outer and a soft inner layer, the latter almost spherical, the former simply stretched across the hollow so as to roof it in and protect the latter.

Pupa slightly more than 5 mm. long in its natural position with the head and abdomen flexed. Eyes large, greyish; antennae curved back above the eyes; mandibles strong and horny, each strongly toothed on the biting margin, the teeth becoming progressively smaller behind—the distal tooth especially being much larger than the penultimate one; third legs folded separately from the other two pairs and almost entirely concealed from view by the wings, from beneath the extremities of which the claw is seen projecting (fig. 8); wings very dark coloured, almost black; the rest of the pupa dirty whitish, speckled with brown.

COMPARISONS WITH PREVIOUSLY DESCRIBED SPECIES.

Ascalaphidae.

As noted above the two Ascalaphid larvae here described differ from all whose habits are at present fully known in that they live upon tree-trunks where their form and colour alone render them sufficiently inconspicuous to allow them to capture their prey; and they do not attempt to conceal themselves further.

One of them has been reared to maturity, and proves to belong to the genus *Pseudoptynx*, Weele. This genus belongs to the sub-family Acmonotinae, which only includes one other known genus *Acmonotus*. The only larvae belonging to this sub-family that have hitherto been described are of the latter genus. Van der Weele has described and figured the larva of *A. sabulosus*, Walk. (1908, pp. 204-5, fig. 157), and a comparison of his account with that of the *Pseudoptynx* of the present paper will show that the former differs from the latter in many respects: notably in the extraordinarily broad head (which is much broader than long), the long single

tooth on the mandibles, the almost circular body (meso- and metanotum and abdomen together), and the uniformly elongated lateral processes. These characteristics are precisely those noted by Hagen (1873 p. 59) as diagnostic of larvae of *Suphalasca*, a genus in which *sabulosus* and other species of *Acmonotus* were included before the latter genus was founded and made the type of a separate subfamily. Hagen's statement concerning the distinctive larval characters of *Suphalasca* appears to have been based on a description published by Brauer (see Hagen, 1873, p. 43), but the two species (*dietrichiae* and *subtrahens*) to one or other of which he (Hagen) provisionally refers Brauer's larva are retained in the genus *Suphalasca* in Van der Weele's Monograph of 1908. Froggatt (pp. 363-4) also describes a larva which he regards as that of *Suphalasca sabulosa*, Walk., but as Van der Weele himself points out, this is a very different form from his larva; and as a matter of fact it does not come within Hagen's definition of the larval characters of *Suphalasca*. Possibly, however, Froggatt's larva may belong to a true *Suphalasca*, and Brauer's, which was not determined with certainty, to some species now separated as *Acmonotus*, in which case Hagen's diagnosis would still appear to hold good, but only to the *Acmonotus* section of the undivided genus to which he applied it. Assuming this to be the case there are at present published the following descriptions of larvae of the Acmonotinae:—Van der Weele on *Acmonotus sabulosus*, Walk., Brauer (followed by Hagen) on some closely-allied (? the same) species; and the above description of a species, as yet undetermined, of *Pseudoptynx*.

As will appear from the above description, the larvae of *Acmonotus* are of a very abnormal form. The *Pseudoptynx* larvae, on the contrary, are in no way abnormal. Of all the larvae hitherto described the *Pseudoptynx* larvae most closely resemble Hagen's "*Glyptobasis incusans?* oder *Ascalaphus? cervinus?*" from Ratnapura, Ceylon (1873, pp. 44—46). This they resemble so closely that it is not at all impossible that the shrivelled larvae from which Hagen drew up his description may have been in reality the young of this very species. Up to the present, however, no *Pseudoptynx* of any species appears to have been recorded from Ceylon.

The undetermined Ascalaphid larva with its curiously modified lateral processes, is a much more abnormal creature and we are unable to connect it with any other form known to us.

Myrmeleonidae.

The larvae of *Myrmeleon contractus* are chiefly remarkable on account of their manner of life. Not only do they not form pits, a habit hitherto believed to be universal with the larvae of this genus, but neither do they hide under stones or rubbish, or cover themselves over with a cloak of foreign matter as do the larvae of some other genera. They only attach a little dust in a thin layer to the dorsal surface of the head and thorax, the abdomen being apparently always bare in spite of its pale colour. The abdomen is however much less conspicuous on a background of bark than

might be supposed; and if these larvae feed, like other Myrmeleons, upon ants, the covering of the anterior part of the body must be quite sufficient in itself to render them inconspicuous to any victim approaching from in front—for to an ant the rest of the body would appear so much foreshortened as to be scarcely noticeable. And it is very natural that in India an ant-eating insect should take to a life upon tree-trunks, up and down very many of which hosts of ants are perpetually streaming, numbers having their nests beneath the bark.

Redtenbacher (1884, pp. 544-5) divides Myrmeleonid larvae into two main classes:—A, those which walk forwards and do not construct pits; and B, those that construct pits. And he subdivides these according to structure, the latter being divided according to their method of progression also. Although the larvae of *Myrmeleon contractus* would clearly fall into class A, they are distinguished from all of the four groups of this class by the structure of the ninth segment. And of the three groups in class B they agree in structure (apart from a minor difference in the armature of the mandibles, which is referred to below) only with the *Myrmeleon* group, in spite of the fact that they always walk forwards and never backwards.

Thus in the classification of Myrmeleonid larvae habits may be misleading; and in this case at least the structure of the eighth and ninth segments is a safer guide to identity and may be relied on with absolute security. The larvae of *Myrmeleon contractus* differ however from all the Myrmeleonid larvae described by Redtenbacher in the much greater proportional breadth of the body, and from all the Myrmeleons in having the third tooth on each mandible slightly shorter instead of longer than the second. In the latter character they tend to resemble *Palpares* and some species of *Acanthaclisis* among free-living forms, and *Creagris* and *Myrmecalurus* among pit-makers; but from all of these they differ in that the third tooth is longer and not shorter than the first.

The pupa resembles in general characters that of the “Formica-leo” (*Myrmeleon formicarius* of Hagen and *M. europaeus* of Redtenbacher) described by Reaumur (1742, pp. 368 and 373, xxxiv, figs. 3-5).

LIST OF PAPERS CONSULTED.

Those marked with an asterisk contain descriptions of larvae from the Oriental Region.

1742. Reaumur, M. de—“Mem. pour servir à l’Histoire des Insectes.” Vol. vi, pp. 333-386, pl. xxxii-xxxiv.
1827. Guilding, L.—[On *Ascalaphus macleanianus*.] *Trans. Linn. Soc.*, xv, 1824-5 (1827), pp. 509-512.
1833. Percheron, A.—“Note sur la larve du *Myrmeleon libelluloides*.” *Mag. Zool. des Années 1831 à 1838*, Section 3, classe ix; 4 pp., pl. 59.

1842. *Lefebvre*.—[On an Ascalaphid larva.] *Ann. Soc. Ent. France* (i), xi (1842), pp. xvii-xix.
1846. *Guérin-Ménéville*.—[On the larva of *Ascalaphus longicornis*.] *Ann. Soc. Ent. France* (ii), iv (1846), pp. cxv-cxvi.
1871. *Emerton, J. H.*—"The Ant-Lion." *Amer. Nat.*, iv (1871), pp. 705-709.
1872. *Hagen, H. A.*—"On the Larvae of the Hemerobina." *Proc. Boston Soc. Nat. Hist.*, xv (1872-3), pp. 243-248.
- *1873. *Hagen, H. A.*—"Die Larven von *Ascalaphus*." *Stett. Ent. Zeit.*, Jahr. xxxiv (1873), pp. 33-62. [*Helicomitus* (?) sp. from Saugor, Central India, pp. 43-44; and *Glyptobasis incusans*? oder *Ascalaphus*? *cervinus*? from Ratnapura, Ceylon, pp. 44-46, from the Oriental Region.]
1873. *Hagen, H. A.*—"Die Larven von *Myrmeleon*." *Stett. Ent. Zeit.*, Jahr. xxxiv (1873), pp. 249-295 and 377-398.
- *1873. *M'Lachlan, B.*—"An Attempt towards the Systematic Classification of the Family Ascalaphidae." *Journ. Linn. Soc.*, Zool., xi (1873), pp. 219-276. [Eggs and larvae of a species from Saugor, Central India, very briefly described on p. 225.]
1878. *Ragonot*.—[Larva of *Ascalaphus longicornis*.] *Ann. Soc. Ent. France* (5), viii (1878), p. cxx.
1882. *McCook, H. C.*—"On the Habits of the Ant-Lion." *Proc. Philadelphia Acad.* (1882-1883), pp. 258-260.
- *1884. *Redtenbacher, J.*—"Übersicht der Myrmeleoniden-Larven." *Denkschr. Kais. Akad. Wiss. math. nat. Classe*, xlvi (1884), pp. 335-368, pl. i-vii. [Two species from the Oriental Region, one from Pondicherry, p. 358, pl. v, figs. 70-74 (genus?), and a *Myrmeleon* from the Dekkan, p. 361, pl. vi, figs. 88-89.]
- *1888. *Westwood, J. O.*—"Notes on the Life-History of Various Species of the Neuropterous Genus *Ascalaphus*." *Trans. Ent. Soc. London* (1888), pp. 1-12, pl. i-ii.
1902. *McClendon, J. F.*—"The Life-History of *Ulula hyalina*." *Amer. Nat.*, xxxvi (1902), pp. 421-429, text-figs. 1-15.
1902. *Froggatt, W. W.*—"Notes on Australian Neuroptera and their Life-Histories." *Proc. Linn. Soc. N. S. Wales*, xxvi (1902-3), pp. 358-369.
1908. *Rengel, C.*—"Über *Myrmeleon fornicarius*, L." *Sitzb. Ges. Naturforsch. Freunde*, Jahrgang (1908), pp. 140-149, pl. viii.
- *1908. *Van der Weele, H. W.*—"Ascalaphiden, Monographisch Bearbeitet." *Collections Zoologiques du Baron Edm. de Sélys Longchamps; Catalogue systématique et descriptif*. Fasc. viii; Bruxelles (1908). [Larvae of *Acomotus sabulosus*, Walker, from South Australia, pp. 204-205; *Hybris borneensis*, Weele, from Borneo, pp. 239-240; and *Ascalaphus cunii*, Sélys, from Spain and Portugal, pp. 302-303, all described and figured.]